ROLE OF CLIMATE ON GRAPE CHARACTERISTICS OF 'MOSCATO BIANCO' IN PIEMONTE (ITALY)

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Summary

The study's purpose was to realize the role of climate on phenological aspects of 'Moscato bianco' grapevine cultivar in different production zones of wine Moscato d'Asti docg in Piemonte (Italy) and his effects on vintage time. The cartography display (scale 1:25.000) of different parameters of exposure, altitude, climate, bioclimatic indexes, phenological phases, grape's quality (alcohol, acidity, pH) allows to zone the Moscato d'Asti production area in three sub-zones: between an early zone and late zone there is a intermediate zone with more or less earliness.

Résumé

L'objectif de l'étude était de connaître le rôle du climat sur les aspects phénologiques du cépage « Moscato bianco » dans les différentes zones de production du vin Moscato d'Asti aocg en Piemonte (Italie) et ses effets sur l'époque de vendange. La représentation cartographique (échelle 1 :25000) de exposition, altitude, climat, index bioclimatiques, phases phénologiques, caractéristiques physique- chimiques des raisins (alcool, acidité, pH) a permit de partager la zone de production de Moscato d'Asti en trois sub-zones avec différentes époques de vendange où, entre une précoce et une tardive il y a une sub-zone intermédiaire caractérisée par situations de majeur et mineur précocité .

Introduction

In 1999 began a three years multidisciplinary study, financed by Regione Piemonte
The study's purpose was to assess the role of climate on phenological aspects of 'Moscato bianco' grapevine cultivar in different production zones of the Moscato d'Asti docg wine in Piemonte (Italy) and his effects on ripening time.

Materials and methods

We have carried out three levels of analysis:

1) geographical and topographical data collection with a GIS system, climatic and bio-climatic data collection on 16 meteorological stations, phenological and grape quality data collection in 30 selected vineyards;
2) study of the relationships between development-ripening rapidity and climatic aspects in different zones;
3) cartographic display of different bioclimatic, phenological and grape quality parameters.

The field analysis and the thematic maps have been realized in the following main steps:

1) Acquisition of cartographic base at 1:25.000 scale of "Moscato d'Asti" area;

2) Acquisition of all information layers, not already available, necessary for correct analysis and data processing (boundaries, rivers and creeks, railways stations position, main localities etc.)
3) Land digital model, by means of which we have produced information layers concerning the topographical and geographical characteristics of the territory (altitude, slope, exposure…).

For climatic characterisation we have used data of temperature, rainfall, relative humidity and leaf-wetting, collected by 16 electronic stations during the five years period 1997-2001.
We have also used temperature data from 8 mechanic stations, in the three years period 1999-2001, to increase the survey network at higher altitudes (fig.1).
The bioclimatic indexes values of active temperatures summation (STA), thermic excursions summation (SET), and Huglin index have been calculated for the 24 stations during the period 1999-2001.
Phenological and grape quality parameters have been measured in 30 vineyards, located in the whole Moscato d'Asti docg production area and selected in different territorial, climatic and growing conditions.
On every vineyard we have assessed the date of budbreak, of bloom (50% full bloom) and veraison (when must reaches to 10° Babo). During ripening, weekly we have controlled potential alcohol concentration, total acidity, pH.

Results

Relationship among geo- morphological, bio climatic, and phenological/qualitative data.
In the study area altitude ranges between 110 and 710 m, but mainly between 200 and 250 m. (fig.2)
The main altitude range is found at the lower latitudes (South) towards Langhe hills, where it is over 800 m , in North- west there is Tanaro valley, past there is Monferrato hills and finally in North- east there are lower altitudes.
Vineyards at higher altitudes delay bloom and, mainly veraison. Besides, during ripening, at highest altitudes sugars level is lower, while the acidity is higher .
For linalool concentration the altitude belt from 350 to 350 m is favourite.
The main exposure is eastern, while the south- western has the lowest representativeness. The viticulture isn't located on the plain. Generally the main exposures are from the north-east to the north-west, through the north (fig. 3).
The North exposure (or interaction among exposure and other variables) tends to delay veraison without clear influences over other phenological phases. In North and East exposures we have observed a reduction in sugar accumulation and an increase in acidity, and thus a ripening delay.
Huglin's index, between 1990 and 2600 °C, is the best index to express the phenological development and the ripening rapidity. Increasing Huglin index, the budbreak and bloom dates decrease in a linear way. Instead the relationship with veraison doesn't seem linear.
The veraison date is early with an increase ratio of about 0,1 days/°C (to advance of 1 day , 10 °C have to summed to IH) until the IH reaches 2100, afterwards further Huglin's index increases don't advance the veraison.
There is a inverse relation between HI and total acidity until 2100 °C, afterwards further temperature increases don't give further acidity reduction (the same situation showed for veraison).
From 1950 to 2100 IH, 50°C of thermal summation are needed in Huglin's index to lower by 1 g/l total acidity in harvest. In this range, the potential alcohol has the same trend.(fig.4)

Cartographic display of different bioclimatic, phenological and grape quality parameters

Huglin's index ranges from 1900 to 2600 (fig.5). The values from 2100 and 2400 concern most of territory This index has showed a strong inverse relation with altitude. At the same time it increased from south to north and higher latitudes.

In most of the studied area the veraison has taken place from the first to the second week of August. This phenological step showed a good relationship with Huglin's index and veraison took place earlier where the index was higher (fig.6).
About potential alcohol concentration, assessed as on 5 September, the average value is 12,5 %. About the general trend, we observed an increase with lower altitude and with higher altitude (fig.7).

Conclusions

The detailed scale has allowed to show some sub-zones connected to ripening earliness of the studied area.
The thematic maps obtained with this project could be used to plan agronomic and grape growing strategies. In particular, knowledge of expected phenological dates and of potential qualitative indexes can allow to plan harvest time.
The phases of budbreak, bloom, veraison have taken place in a range of 10 to 20 days and also more in different zones.
Near harvest we have observed big ripening differences with potential alcohol values mainly ranging from 9% to 13%..
The different maps confirm this conclusion: in the same zones where we have seen lower values of bioclimatic indexes, phenologic phases (budbreak, bloom, veraison) were posticipated and potential alcohol decreased; at the same acidity increased and a pH decreased, showing a clear ripening delay.
Therefore, concerning ripening earliness the production area could be split up in three zones.
Generally grapes located in the northern zone of the production area (with higher thermal summations, lower altitude, lower slope) ripen earlier than vines of the southern zone (with lower thermal summations, higher altitude, higher slope). A few locations in intermediate zone have pronounced differences in earliness between different exposures and between zones of higher or lower altitude. In these cases it is necessary a deeper analysis to better discriminate earlier and later locations.

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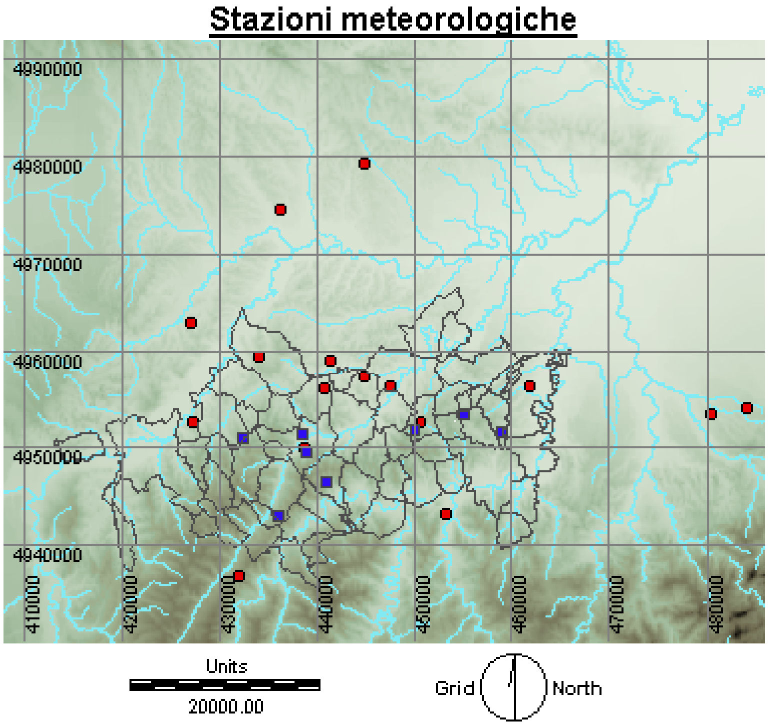

Fig 1 Localisation of meteorological stations*:* ● *electronic stations,* ● *mechanic stations.*

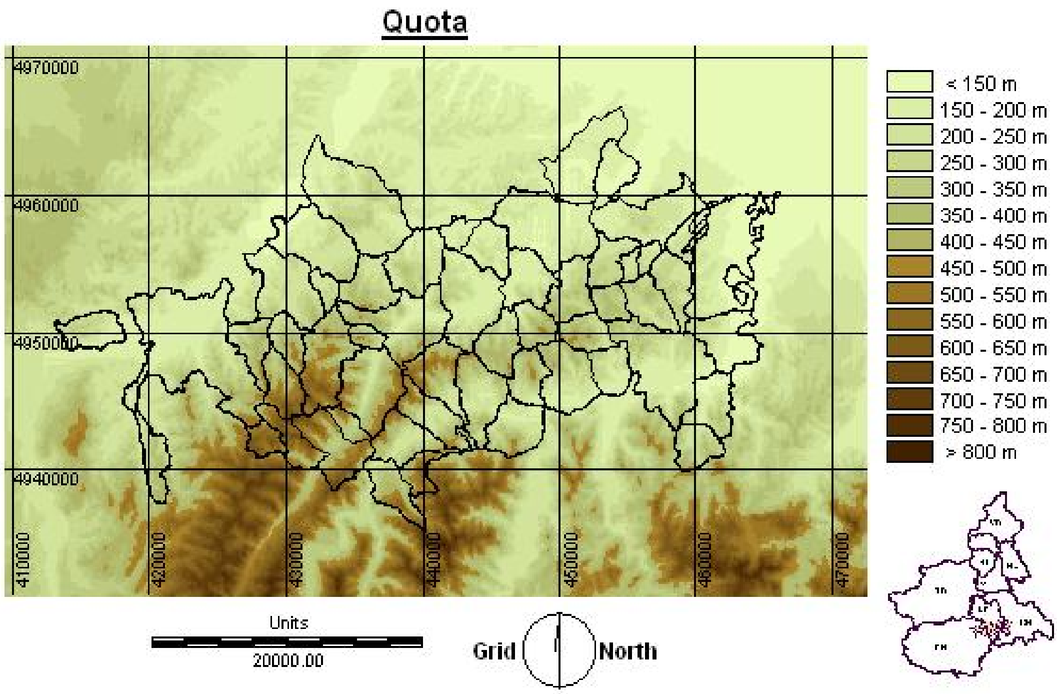

Fig.2 The altitude's map in Moscato d'Asti production area

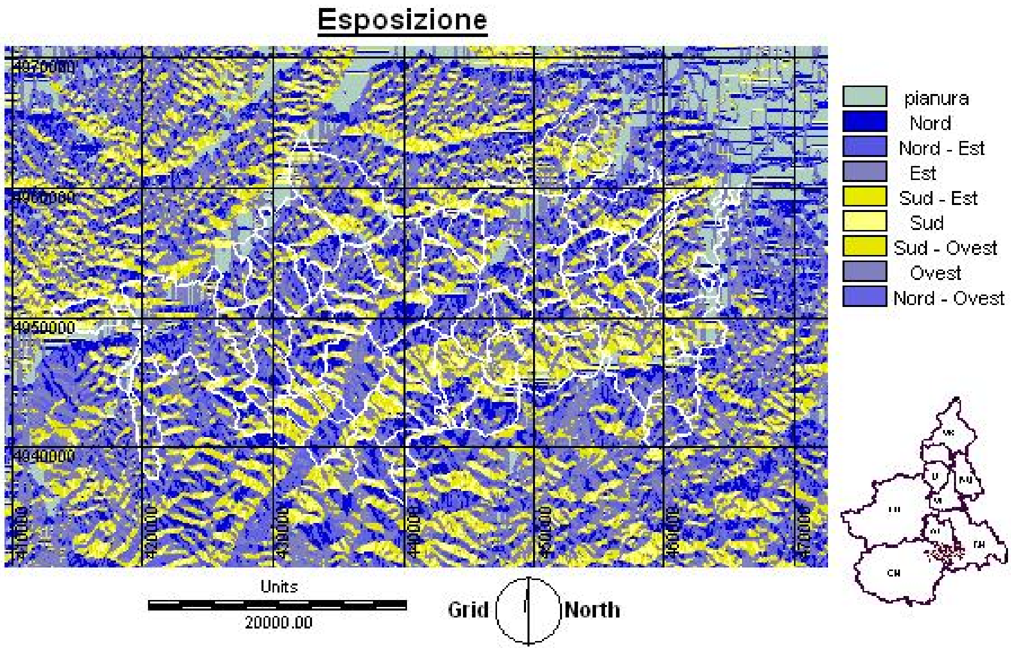

Fig. 3 Exposure in Moscato d’Asti production area

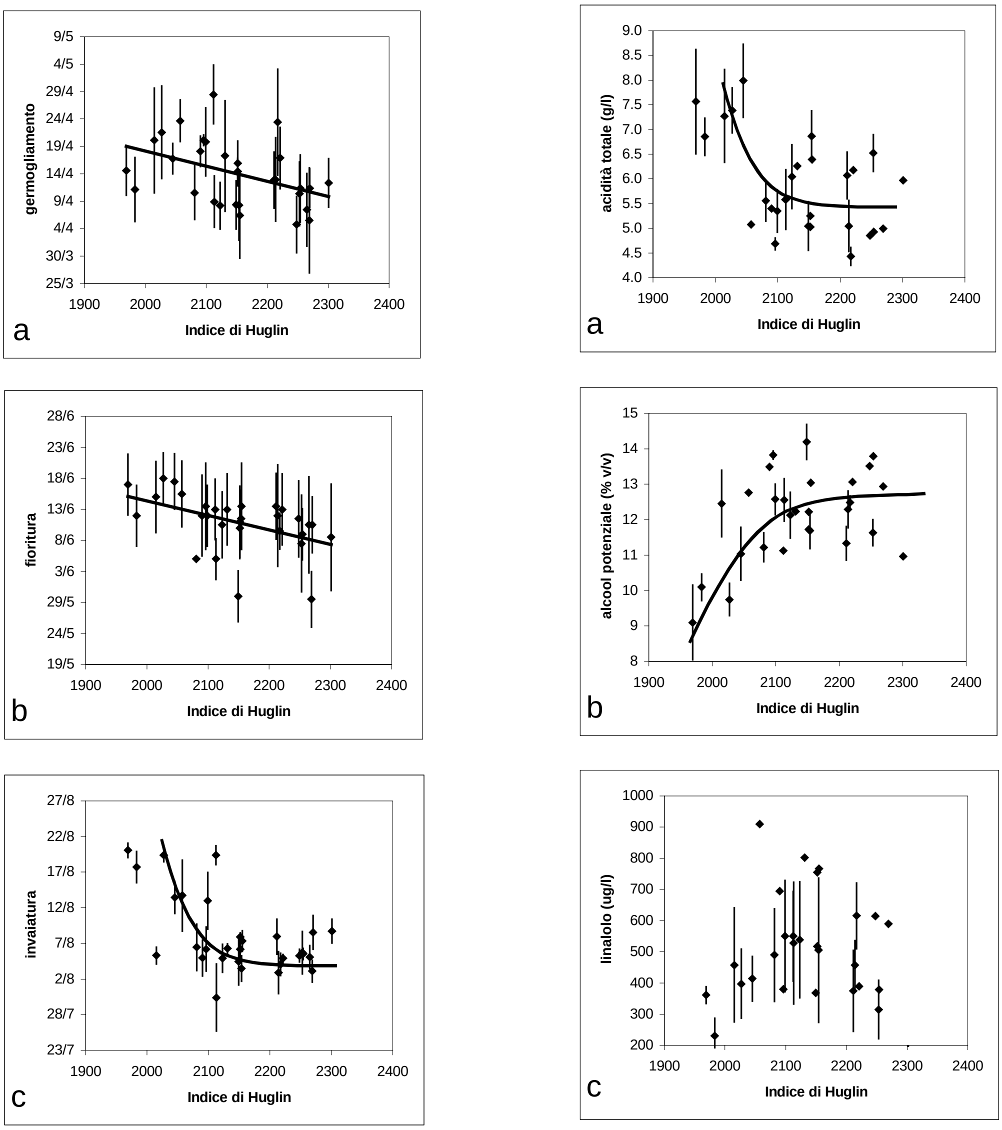

Fig. 4 Three years average phenological parameters and ripening (the bars on every value mean standard error) for all 30 vineyards depending on the Huglin index extracted from spatial patterns.

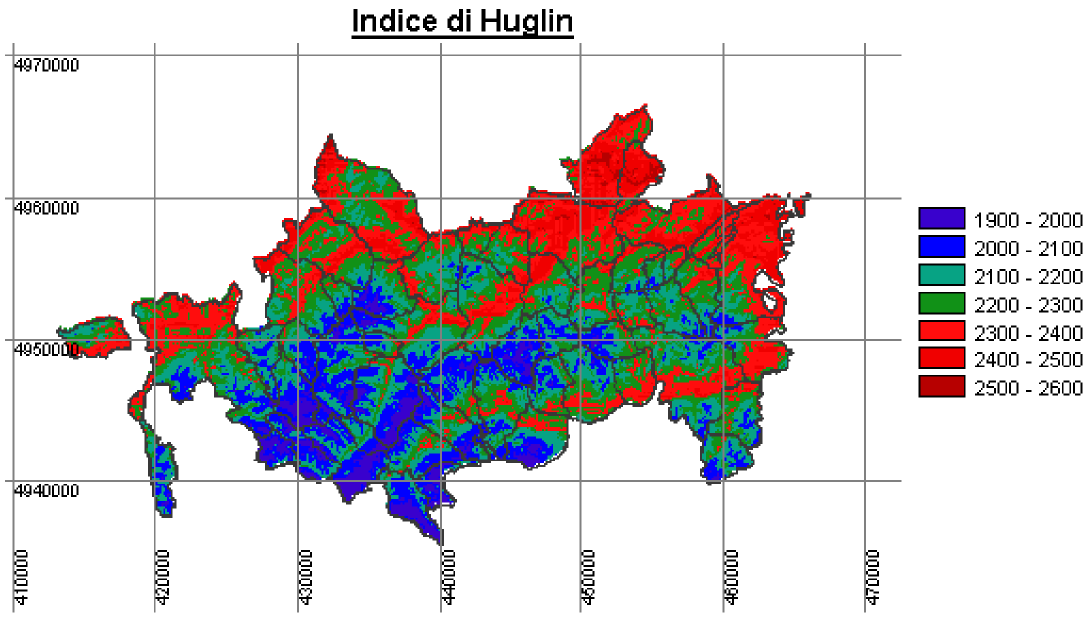

Fig. 5 Huglin index map

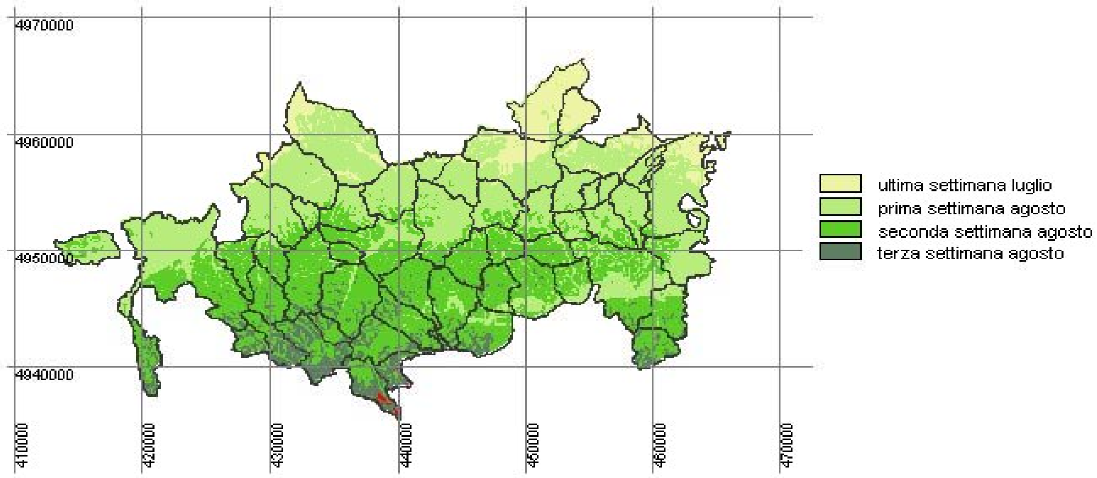

Fig. 6 Veraison map

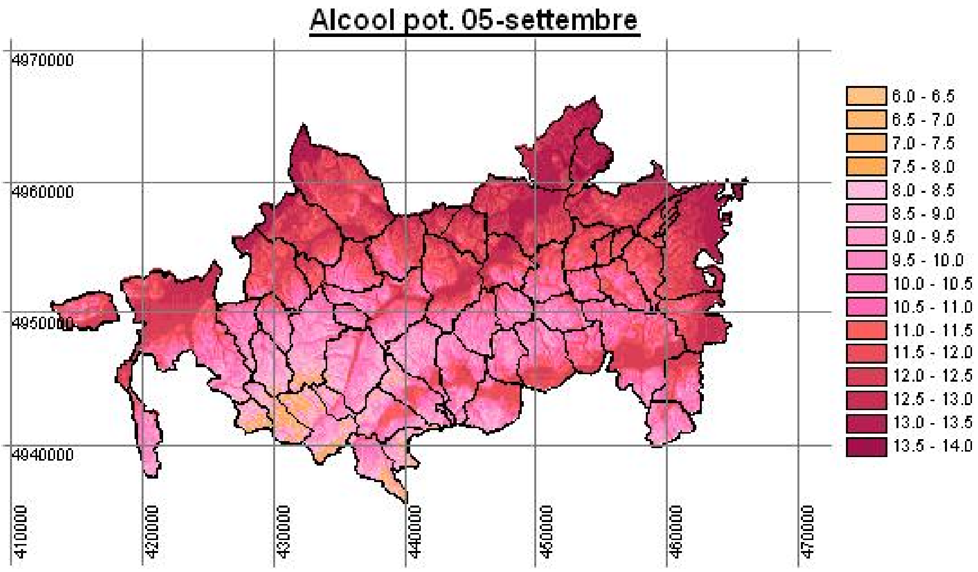

Fig.7 Potential alcohol map (5 September)